

On page 1, between the title and line 1, please insert the following paragraph:

--Summary of Related Applications

D1 This application is a continuation-in-part of application No. 08/483,558, which issued as U.S. Patent No. 5,578,309 on November 26, 1996, which is a continuation-in-part of application No. 08/247,972, filed May 23, 1994. This application is also a national stage application of PCT/US96/18796, filed November 21, 1996, which claims benefit of priority to provisional application No. 60/007,477, filed November 22, 1995.--

Please delete the paragraph at page 3, line 2, and insert the following paragraph:

D2 --An object of the present invention is to provide a vaccine comprising a microbe targeting and attachment molecule which mimics a host cell molecular address such as adhesion proteins, lipid molecules or carbohydrate molecules.--

Please delete the paragraph at page 3, line 28, and insert the following paragraph:

D3 --Advantageously, the invention provides a therapeutic peptide comprising a molecule which mimics the adhesion molecule of a pathogen and interacts with receptor molecules of a cell selected from the group consisting of leukocytes, endothelial cells, epithelial cells and other target cells of the host. The therapeutic peptide molecule may react specifically with receptor (ligands) of host adhesion molecules. Conversely, the invention provides a therapeutic peptide or carbohydrate comprising a molecule which mimics the adhesion molecule of a host cell and interacts with (blocks) the adhesion molecules of a pathogen.--

Please delete the paragraph at page 5, line 20, and insert the following paragraph:

D4 --The attachment molecule may resemble a selectin, such as a molecule substantially and functionally similar to a selectin. In a preferred embodiment the selectin molecule is selected from those similar to E, L and P selectins.--

Please delete the paragraph at page 8, line 19, and insert the following paragraph:

D5 --The assay for detection, identification and enumeration of respiring microorganisms comprises the steps of:

- a) passing a microbial sample through a collecting device to capture the cells;
- b) adding to the collecting device a fluorochrome dye specific for the detection of respiring cells and allowing the dye to incubate;
- c) treating the collected sample with a reactive fluorescent antibody which reacts with a microorganism of interest present in the microbial sample;
- d) mounting said collecting device for examination by fluorescence microscopy in which a suitable light system is used to excite the fluorochrome dye and fluorescent antibody to fluoresce; and
- e) quantifying the fluorescence as a measure of the amount of said respiring target microbial cells.

Preferably the fluorochrome dye specific for the detection of respiring microbe is taken up by respiring microorganisms and reduced to insoluble formazan crystals by the cytochrome system of said microbes. More preferably the fluorochrome dye specific for the detection of respiring cells is a tetrazolium compound. Most preferred is tetrazolium compound which is 5-cyano-2,3-ditolyl tetrazolium chloride (CTC).--

Please delete the paragraph at page 10, line 26, and insert the following paragraph:

D6 --The peptide alternatively reacts with a receptor of the cytokine or chemokine family of host adhesion molecules or mimics the host adhesion molecule and interacts with adhesion molecules of the pathogen.--

Please delete the paragraph at page 10, line 30, and insert the following paragraph:

D7 --The inventors have found that naturally occurring endogenous peptide antibiotics of vertebrates act as an effective deterrent to viral, bacterial, fungal, and parasitic infections. Gene-encoded peptide antibiotics are ubiquitous components of host defenses in mammals, birds, amphibian, insects, and plants. Their *de novo* synthesis of release from storage sites can be induced rapidly, which makes them particularly important in the initial phases of resistance to microbial invasion. The endogenous antimicrobial peptides of animals are usually products of single genes and are synthesized as preproteins. Multistep processing yields the mature peptide or group of peptides, which can act by inducing microbial membrane permeabilization or by adhesion to the microbial surface. The adhesive peptides act as lectins binding to the carbohydrates or lipids presented on the surface of infectious microbes thus making the organism more susceptible to immune detection and clearance. These binding peptides may also act to block the microbial host adhesion events leading to infection.--

Please delete the paragraph at page 12, line 8, and insert the following paragraph:

D8 --Naturally occurring, or engineered, mAbs or peptides with anti-adhesive properties targeting host-parasite adhesion associated signaling with adhesion are effective for producing diagnostics, therapeutics and vaccines for host infections requiring microbial binding to host tissues.--

Please delete the paragraph at page 12, line 15, and insert the following paragraph:

D9 --Many pathogens trafficking through the vascular system use adhesion pathways operating under shear as a means of seeding various tissues. The inventors believe this concept is universally applicable and show the use of host adhesion pathways unique to different anatomical systems (respiratory, gastrointestinal tract, urinary tract, etc.) by a given pathogen. Thus, a new approach to defining the virulence of many bacterial, viral, fungal and parasitic organisms may be directed to the detection and characterization of various prokaryotic and eukaryotic adhesion proteins that infiltrate the host's communications network. Several studies on different host-parasite relationships reveal how pathogens use the cell-cell adhesion systems of the host during the course of an infection. The results of some salient studies are presented to illustrate the types of functional mimicry that has evolved to allow a microbe to infiltrate the host cell-cell networks and to direct the course of infection.--

Please delete the paragraph at page 13, line 9, and insert the following paragraph:

D10 --Although it is clear that protein-carbohydrate interactions control a myriad of biological events, the low binding constants for protein-carbohydrate couples have raised questions regarding the precise role of carbohydrate ligands in biological communication.

However, a model for microbial toxin-host cell interaction proposed by St. Hilaire *et al.* (21) calls attention to the similarities of protein-carbohydrate interactions found in microbial adhesion systems to those employed by the host and notes that the latter interactions are involved in specificity but not tight binding of the receptor/ligand pairs. Tight binding appears to be promoted by protein-protein or protein-lipid interactions. This principle has been demonstrated for neutrophil recruitment where recognition is mediated by protein (selectin)-carbohydrate (sialyl Le) binding but tight binding and flattening are the result of protein-protein (integrin/ligand) or protein-lipid binding. Similarly, St. Hilaire *et al.* have shown that the adhesion of the B-subunit (one of the smallest known lectins) of the VTEC holotoxin invokes both protein-carbohydrate (for targeting the toxin) and protein-lipid interactions (for entry of the toxin into the cell) which are also reminiscent of the mode of action of botulism, pertussis and diphtheria toxins (22). The generality of this motif requires structural and energetic studies on a large array of protein-carbohydrate-lipid-mediated biological recognition systems.--

D10

Please delete the table at page 16, line 14, and insert the following table:

--Table 1

Adhesion Molecules Examined Under Shear

Adhesion Molecules Expressed on Optimal Function Conditions

	Leukocyte	Endothelium	Shear	Static
E-selectin	-	+	+	-
P-selectin	-	+	+	+/-
L-selectin	+	-	+	-

MAdCAM-1	-	+	+	+
PNAd-1	+	+	+	-
VCAM-1	+	+	+	+
ICAM-1	+	+	+/-	+
Mac-1	+	-	-	+
LFA-1	+	-	-	+/-
VLA4	+	-	+	+
beta-1	+	+	-/+	+
LPAM	+	-	+	+
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Please delete the paragraph at page 18, line 1, and insert the following paragraph:

--Leukocytes that traffic in the blood are variously classed as a) lymphocytes, b) neutrophils, c) monocytes and d) platelets. Other cells that interact with or are derived from blood borne cells include antigen presenting cells (M cells, dendritic cells, macrophages) and cells that elaborate or secrete pharmacologically active compound (mast cells, eosinophils). The lymphocyte population includes subsets of antigen-reactive T cells defined by different functional roles they play (cytotoxic, helper cell, suppressor, etc.) and the combination of surface antigens or receptors they display. Two distinct subsets of T cells are instrumental in directing the immune response of the host into cell-mediated immune response (Th1) or predominantly a humoral immune response (Th2). Another lymphocyte population, the B cells, is characterized by the presence of

D12 membrane-bound immunoglobulins, initially monomers of IgM and later, IgD molecules and, after maturing into plasma cells, produce and secrete immunoglobulins.--

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Please delete the paragraph at page 18, line 20, and insert the following paragraph:

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D13 --Macrophages develop from blood-borne monocytes and bear a number of cell surface receptors for antibody, complement and various cell-cell interactions that promote movement through endothelia and epithelia. Dendritic cells are also large, motile cells and, like macrophages, are involved in the processing/presentation of antigens to lymphocytes.--

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Please delete the paragraph at page 19, line 27, and insert the following paragraphs, which include a new paragraph break:

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D14 --Epithelial cells line the luminal surfaces of the intestinal tract, genitor-urinary tract, upper respiratory tract and various organs of the mammal. Epithelial cells express many members of the integrin family and possess a host of different glycoconjugates that function as counter-receptors for pathogen adhesion molecules (PAMs).

Examples of nervous system cells include astrocytes, glial cells, schwann cells and neurons. The dominant host adhesion molecules found on nervous system cells are NCAM and ICAM. Ligand counter-receptors that bind to PAM are sialic acid-rich structures.--

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Please delete the paragraph at page 20, line 4, and insert the following paragraph:

D15

--Endothelial cells may display one or more adhesion molecules depending on (a) stimulation by inflammatory mediators and (b) their location in tissue or an organ environment. The ICAM subfamily is generally expressed on endothelial cells as a consequence of stimulation by inflammatory mediators including lipopolysaccharide,  $\gamma$ -interferon, interleukin-1 and tumor necrosis factor (TNF) elaborated during infections or tissue damage. VCAM has induction kinetics and function similar to ICAMs but interacts only with the VLA-4 integrin while ICAMs bind to LFA-1 integrin. Examples of dominant host adhesion molecules on endothelial cells include ICAM-1, VCAM-1, MAdCAM-1 (Peyer's patch), and PNAd-1 (peripheral lymph node).--

Please delete the paragraph at page 20, line 15, and insert the following paragraph:

D16

--Lymphocytes in the blood enter lymph nodes by binding to specialized "high" endothelial cells. Molecules, termed "addressins" selectively expressed on specialized HEV in different types of lymph nodes function as homing receptor ligands. Thus, endothelial cells expressing MAdCAM-1 are found in the high endothelial venules of the Peyer's patches and lamina propria, and the lymphoid system associated with the intestine. Endothelial cells expressing PNAd-1 are found in peripheral lymph nodes.--

Please delete the paragraph at page 22, line 6, and insert the following paragraph:

D17

--Candidiasis – Research on *C. albicans* has shown that it expresses a phosphomannoprotein on its surface responsible for the ability of hematogenous yeast cells to adhere (presumably to an integrin) on mouse splenic marginal zone macrophages



D17 and peripheral lymph nodes (29). *C. albicans* binding to fibronectin in the extracellular matrix of blood vessels has been implicated as playing a direct role in promoting fungal adhesion for blood disseminated fungal disease (30).--

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Please delete the paragraph at page 23, line 23, and insert the following paragraph:

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D18 --A second property of PT is the ability to upregulate the function of the integrin family of leukocyte adhesion molecules. The ligation of a carbohydrate by the PT adhesion event upregulates the integrin CR3 (Mac-1) which allows the second adhesin FHA, a specific ligand for CR3, to adhere and trigger uptake and survival of the bacteria in the macrophage. Thus, the PT adhesion has two functions in the infectious process: address recognition and signaling the macrophage to increase receptor sites for the organism.--

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Please delete the paragraph at page 25, line 27, and insert the following paragraph:

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D19 --Two forms of adherence derive from the expression of eaeA genes and/or plasmid encoded loci (40, 41, 42). The first or initial (localized) adherence is promoted by an 19 kDa EAF fimbrial adhesin referred to as the bundle forming pilus (BFP). The BFP adhesin causes adherence to the surface of the microvilli and the initiation of events that lead to effacing. Interestingly, the amino acid sequence of BFP of *E. coli* is similar to the pili of *Vibrio cholerae*, *Neisseria gonorrhoeae*, *Neisseria meningitides*, and *Pseudomonas aeruginosa*, all of which are members of the type IV fimbrial family. It is proposed that the 19 kDa adhesin protein reacts with a carbohydrate ligand on the epithelial cell or, less likely, a specific carbohydrate epitope associated with mucin. This

D19 adherence and subsequent microcolonization event is followed by the transduction of a signal that results in elevated intracellular calcium levels, activation of host cell protein tyrosine kinases, fluid secretion and in severe verotoxic *E. coli* infections, profound changes in cytoskeletal structures. A second adherence event promoted by a chromosome-encoded 94-kDa outer membrane protein (OMP) containing an adhesion structure referred to as intimin permits the organism to adhere intimately to the epithelial cell plasma membrane and appears to amplify cell signaling leading to marked effects on cytoskeletal proteins of the epithelium and, in some instances, to invasion of the submucosa. The amino acid sequence of *E. coli* intimin is highly similar to those of the invasions of *Yersinia pseudotuberculosis* and *Y. enterocolitica* (44). Invasins bind with a high affinity to members of the beta-1 family integrin receptors to mediate the efficient uptake of bacteria. There is reason to believe, therefore, that OMP adhesions are used by pathogenic *E. coli* to pass through beta 1 integrin doors (in contrast to beta 2 integrins in respiratory infections) and maneuver along the cytoskeleton of epithelial cells.--

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Please delete the paragraph at page 26, line 28, and insert the following paragraph:

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D  
20 --*Helicobacter pylori* has effectively colonized the majority of the world's population and is now accepted as the major cause of chronic gastritis and the formation of peptic ulceration (45). The bacterium is tropic for epithelial cells and the mucus layer in the stomach lining. Adherence to gastric epithelial cells is mediated by lectin-like adhesins interacting with fucosylated blood-group antigens associated with blood-group O phenotype (46). Surface epithelial degeneration is a probable result of the activity of

D20

bacterial products including cytotoxins, urease and pro-inflammatory products such as  
LPS.--

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Please delete the paragraph at page 29, line 24, and insert the following paragraph:

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D21

--Herpesvirus. Of all known viral proteins, few have significant sequence  
similarity to host cellular proteins but viral agents rely on recognition molecules on the  
host cell for attachment and entry. However, the RNA retroviruses and two classes of  
DNA viruses, the poxviruses and herpesviruses, employ molecular mimicry of cytokines  
to subvert host cellular functions (20). The herpesvirus chemokine-receptor homologs  
mimic host membrane proteins transmitting a signal to the cytoplasm of host leukocytes  
that ensures a cytosolic milieu for herpesvirus replication and/or the establishment of  
latency.--

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Please delete the paragraph at page 30, line 1, and insert the following paragraph:

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D22

--The revolutionary conclusion the inventors have drawn from these studies is that  
most, if not all, pathogens have "learned" to infiltrate the host's network by using  
adhesion molecules that functionally mimic those of the host. The applications of the  
present inventors' understanding of the functional and molecular character of prokaryotic  
adhesion molecules has led to the development of a new generation of diagnostic  
reagents, therapeutic compounds and vaccines.--

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Please delete the paragraph at page 30, line 10, and insert the following paragraph:

D23  
--The inventors have developed new reagents to detect potent immunogens for immunization against functionally similar but antigenically distinguishable adhesion molecules both of microbial origin and identified through "*in vitro* evolution". In addition new adjuvants are developed that recruit a specific population of immunologically competent cells into organ and tissue sites (i.e., mucous membrane of the intestinal tract or nasopharyngeal region) where infectious adhesion events are likely to take place.--

Please delete the paragraph at page 30, line 33, and insert the following paragraph:

D24  
--The function and characteristics of several pathogen-host cell adhesion systems have been identified by the inventors using an *in vitro* shear assay system. These host-parasite adhesion systems include but are not limited to verocytotoxic *E. coli*, *T. foetus*, *C. albicans*, and Hanta virus. Monoclonal antibodies have been developed against microbial adhesion factors to (1) aid in the detection and characterization of adhesions and their counter receptors on target cells and (2) define the dynamics of *in vitro* adherence events with appropriate target cells. The invention defines the nature and function of adhesion interactions in each *in vitro* target cell-pathogen system.--

Please delete the paragraph at page 31, line 30, and insert the following paragraph:

D25  
--To prepare and use in vaccine formulations, the integrin-like attachment molecule (adhesin) is defined and prepared as described herein. The key to success is dependent on (1) an amino acid sequence of the adhesive site of the adhesin that is encoded by microbial genes, hence is foreign (immunogenic) to the mammal and (2)

D25 presentation to the immune apparatus is in an aggregated form or a vehicle that stabilizes and protects it from degradation *in vivo*.--

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Please delete the paragraph at page 32, line 3, and insert the following paragraph:

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D26 --The integrins VLA, Leucam and cytoadhesions, in their native and functional form, are not used in a vaccine preparation because they are of host origin. Instead, microbial peptide homologs of the host-s integrin molecules that react with similar ligands on host cells or extracellular matrix proteins are used. Alternatively, or in conjunction thereto, molecules developed via "*in vitro* evolution", such as through phage-display selection, may be used. In the thesis, the parasite or pathogen has acquired, by chance or, more likely, genetic piracy, a glycoprotein, glycolipid or carbohydrate structure that is functionally similar but antigenically distinct from the host receptor molecule (integrins, selectins or carbohydrate, protein or lipid ligand structures).--

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Please delete the paragraph at page 32, line 29, and insert the following paragraph:

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D27 --The demonstration of effective blocking of adhesion events involved in well defined infectious disease models has provided the basis for developing new vaccines, therapeutics, and diagnostics for many bacterial, viral, fungal, and protozoan infections. This "Adhesion Blocking Technology" (ABT) generates a serried of new products and applications for use in both humans and animals. A few examples of pathogens whose trafficking in the host is a function of adhesion-mediated events and for which effective new and novel diagnostics, therapeutics, and vaccines consisting of or containing adhesion-based reagents are developed include, for example, *Salmonella*, *Shigella*,

D27 *Vibrio, Yersinia, Bordetella, Legionellas, Candida, Helicobacter, Neisseria,*  
*Histoplasma, Leishmania species, Influenza, Hantavirus, HIV virus, Escherichia coli*  
*(VTEC), Trichomonas, Eimeria, Trypanosoma, Epstein-Barr virus, Pneumococcus,*  
*Streptococcus, Rubella, Herpes, Staphylococcus, Chlamydia and Giardia.--*

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Please delete the paragraph at page 35, line 24, and insert the following paragraph:

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D28 --Antisera are generated against each of seven synthetic peptides corresponding to constant and variable sequences of the pili from gonococcal strain MS11 and were assayed for their ability to crossreact with intact pili from both homologous and heterologous strains as in "Antibodies to peptides corresponding to a conserved sequence of gonococcal pilins block bacterial adhesion." Rothbard, J.B., Fernandez, R., Wang, L., Teng, N.N., Schoolnik, G.K., Proc. Natl. Acad. Sci. USA, Feb. 1985, Vol. 82, No. 3, pp. 915-9. The peptides elicit roughly equal anti-peptide responses but vary substantially in their ability to elicit antisera that crossreacted with intact pili. Of the antisera to peptides corresponding to regions of conserved sequence, antisera directed against residues 69-84 are the most efficient in binding pili from all strains tested in both solid-phase assays and immunoblots. Anti-69-84 also efficiently precipitate a tryptic fragment of pili known to bind human endocervical cells. Sera against the two peptides (121-134 and 135-151) previously shown to contain strain-specific epitopes crossreact with MS11 pili equally well, but differ in their ability to bind pili from heterologous strains. Anti-121-134 is strain-specific whereas anti-135-151 bind all pili tested. Each of the sera is examined for its ability to inhibit bacterial adhesion to a human endometrial carcinoma cell line. Sera

D28

generated against residues 41-50 and 69-84 successfully inhibit a heterologous gonococcal strain from binding.--

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Please delete the paragraph at page 37, line 27, and insert the following paragraph:

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--Research into immunity to complex intracellular parasites has recently placed emphasis on the identification of peptide sequences recognized by T-cells, often with the dual objectives of finding species-specific protective epitopes, and of understanding selection of Th1 versus Th2 response patterns, see "Adjuvants, endocrines and conserved epitopes; factors to consider when designing therapeutic vaccines". Rook, G.A., Stanford, J.L., Medical Microbiology, UCL Medical School, London, U.K., Int. J. Immunopharmacol. (England), Feb. 1995, Vol. 17, No. 2, pp. 91-102.--

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Please delete the paragraph at page 39, line 3, and insert the following paragraph:

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--Immunization protocol: Primary immunization antigens were adjusted to 10-20 µg of adhesion vaccines suspended in 0.5ml PBS and emulsified in CytRx® TiterMax® #R-1 at a 50/50 ratio. In all cases, the subcutaneous (SC) route was used to avoid a toxic reaction in mice. Immunized mice were bled at day 14 to test antibody responses by ELISA. If a low titer was found, the mice were boosted with similar dose of antigen and bled and tested at day 28. This procedure was repeated at 2 week intervals until the desired antibody titers for both antigens were achieved.--

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Please delete the paragraph at page 39, line 14, and insert the following paragraph:

D31

--ELISA screening protocol: ELISA assays employed Costar® universal covalent surface immuno assay plates and standard protocols for binding of the bacterial antigens. The system employed a two or three stage development system in which the adhesin or verotoxin was covalently bound to the 96 well assay plates by UV cross linking. The first stage anti-adhesion specific mouse serum of hybridoma supernatant antibodies were diluted and incubated in the plate wells after the adhesions were bound and the plates blocked with BSA. After washing to remove non-specifically bound first stage reagents, a peroxidase coupled anti-mouse second stage antibody was added to the test wells, incubated, and washed. Substrate was then added to the wells to develop the assay which was subsequently read by an automated ELISA plate reader. If the desired sensitivity was not achieved, a third stage to amplify signals was employed.--

Please delete the paragraph at page 40, line 9, and insert the following paragraph:

D32

--Preparation of target cells-- Freshly isolated human umbilical-cord endothelial cells (HUVEC) and commercially purchased HUVEC, which are Factor VII and LDL-receptor positive (cultured in endothelial-cell growth media (Clonetecs, EGM)), or E-selectin cDNA transfectants were grown to confluence on the internal surface of sterile glass 1.36 mm diameter capillary tubes (Drummond Scientific, Broomall, Penn) at least 24 hours prior to shear experiments. Four hours prior to the assay, the endothelial cells were treated with IL-1 (1 unit/ml) to induce E-selectin and other adhesion molecule expression.--

Please delete the paragraph at page 43, line 30, and insert the following paragraph:



--Materials and Methods – Plain immunomagnetic beads were obtained

D33  
commercially, e.g., from Dynal, and coated with adhesion of SLT mAbs using a protocol recommended by Dynal. In essence, the beads were mixed with an appropriate amount of mAb for 30 min. at 4°C, collected in a magnetic particle concentrator, washed 5 times and finally suspended in buffer. Various concentrations of VTEC suspended in phosphate-buffered saline (PBS) were reacted with the coated beads to determine the capture efficiency of the beads. Cells attached to the beads were stained with DAPI and examined using epifluorescence microscopy to determine the number of attached cells. To detect slt in broth culture supernatant fluids, magnetic beads coated with anti-slt were used to capture free slt and identified using a sandwiching technique involving a follow-on fluorescent labeled anti-slt.--

Please delete the paragraph at page 44, line 10, and insert the following paragraph:

D34  
--Suspensions of *E. coli* strains, both 3A (from R.A. Wilson, Penn State University) and 932 (from U.S. E.P.A.), were grown on and harvested from blood agar plates and tryptone medium and used live or fixed in formalin for adherence to magnetized beads and for the conduct of the shear analyses. Upon incorporation of the capillary tube lined with bovine epithelial cells (see above) in the loop system, a flow-induced shear force was established as a pulsatory wave flow peaking at 2 dynes, using Hanks balanced salt solution, HEPES (pH 7.0) as the medium. *E. coli* coated beads, suspended in PBS were infused into the shear flow via an injection port. Interactions of *E. coli* coated beads with epithelial cells were observed by video microscopy and recorded to video tape as a permanent record and for off-line computer image analysis.

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34

Adhesion of bead-bound *E. coli* was analyzed for types of adhesive interactions (rolling or sticking), characteristics (single beads or aggregates), and numbers of adhesive interactions over an interaction interval of ten minutes for the analysis of each condition. Hybridomas and monoclonal antibodies have been produced from spleen cells of immunized mice that recognize various cell surface determinants of the 0157 strain of *E. coli*. The demonstration of shear dependent adhesion of 0157:H7 to bovine intestinal cells confirmed the presence and function of microbial attachment molecules and ligand structures on bovine cells. Adherence was dependent on culture conditions (growth on blood agar) for the organism that appeared to promote the development of adhesions. Sera recognize antigenic differences promoted by cultural conditions in "broth grown or blood agar grown" 0157 *E. coli*. This data suggests that blood agar influences the development of specific cell surface adhesions recognized by these antibodies not found in cells grown in broth. Capture of *E. coli* 0157:H7 from suspension is dependent on the type and quantity of magnetic particle used, as well as the incubation procedures. Up to 98% of the cells in a  $1 \times 10^5$  CFU/ml can be captured under laboratory conditions using these methods. Only 60% of attached cells were removed from the magnetic particles by elution agents. Nearly 100 percent of 0157 inoculated into ground beef samples were detected by a refinement of the immunomagnetic separation (IMS) procedure.--

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Please delete the paragraph at page 46, line 29, and insert the following paragraph:

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D35

--*Candida albicans* is the most common cause of opportunistic fungal diseases in humans and has become the fourth leading cause of cases of nosocomial blood stream infections (15). An important step in the pathogenesis of disseminated candidiasis

appears to relate to the ability of *Candida* cells to adhere to specific tissue locations within the host (7). The search for the appropriate fungal molecules is not trivial, however, as it has been shown that the surface antigenic makeup of *C. albicans* is variable both *in vitro* (3,4,5) and *in vivo* (6). Recently, Cutler *et al.* isolated the candidal adhesins responsible for adherence of *C. albicans* yeast cells to murine splenic marginal zone macrophages and macrophages in specific areas of peripheral lymph nodes (10).

D35 The adhesins are part of the mannan portion (12) of the phosphomannoprotein complex (PMC) and represent a major part of the cell surface. One adhesin has been identified as a  $\beta$ -1,2-linked tetramannose located in the acid-labile part of the PMC and another adhesin resides in the acid-stable part of the complex (11). Detection of mannan adhesins in the serum of patients will thus prove to be a reliable indicator of disease. The adhesins are produced in abundance during growth of the fungus and are readily shed from the cell surface. Using high affinity monoclonal antibodies specific for candidal adhesion moieties, leads to the development of a rapid and reliable test for disseminated candidiasis under the invention.--

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Please delete the paragraph at page 47, line 28, and insert the following paragraph:

D36 --The approach to a diagnostic solution resides with the early and rapid detection of candidal antigens in the body fluids or cells of patients with highly specific monoclonal antibodies (mAbs) directed against candidal antigens shed or released by the organism as it begins to grow and traffic in the body. The invention tests a panel of mAbs specific for an array of candidal cell surface antigens for the detection of candidal antigens in infected mice and humans. The development and use of anti-adhesion

D36  
monoclonal antibodies and monoclonal antibodies directed to undefined cell surface determinants shed by or extracted from *Candida albicans in vitro* may be for the detection of candidal antigens in the body fluids and cells of infected mice and humans. The inventors developed a Candida peptide with an amino acid sequence which mimics a region of the phosphomannoprotein adhesion of *C. albicans*.--

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Please delete the paragraph at page 48, line 10, and insert the following paragraph:

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D37  
--The invention provides a key assay to detect the presence of *Candida* adhesions in serum and on host cells. The assay uses an antibody capture/sandwich ELISA method. Capture antibodies specific for *Candida albicans* antigens were used to coat the surface of polystyrene microtiter plates. After appropriate washing away of unbound capture antibody and blocking of unreacted sites on the plastic, test serum that contain *Candida* antigens was added to the antibody-coated wells, incubated and washed to remove unbound serum. A secondary antibody specific for the antigen was added to the wells, allowed to react with antigen bound to the capture antibodies and washed to remove all unbound materials. A tertiary antibody, which is specific for the secondary antibody and to which an appropriate enzyme is covalently coupled, was added to the wells to allow binding to all secondary antibody in the wells. After washing away unbound tertiary antibody, an appropriate chromogenic substrate specific for the enzyme on the tertiary antibody was added to the wells. As compared to appropriate positive and negative controls, a color reaction in the wells allows determination of the presence of *Candida* antigen in the original test serum.--

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Please delete the paragraph at page 56, line 24, and insert the following paragraph:

D38  
--The isolation of a pathogen's adhesion (attachment) molecule (PAM) which mimics that expressed on host cells begins with its detection and characterization in the inventors' *in vitro* shear assay system using target cells that express the ligand for the adhesion molecule or purified ligands coated on the luminal surface of a capillary tube reaction chamber. The technique for establishing various adhesive substrates on the internal surface of small capillary tubes for the analyses under high and low physiological shear forces of any type of cell-cell adhesive interaction has been developed and perfected by the inventors (Bargatze, R., *et al.* 1994. J. Immunol. 152: 5814-5825; Jutila, M., *et al.* 1994. J. Immunol. 153: 3917-3928; Bargatze, R., *et al.* 1994. J. Exp. Med. 180: 785-792).--

Please delete the paragraph at page 57, line 5, and insert the following paragraph:

D39  
--The detection and characterization of PAMs and their ligands involves the use of an analytical *in vitro* shear flow apparatus (See Figure 2) that provides a reproducible real-time monitoring and quantification of microbial adhesive interactions with a panel of ligand assemblies displayed on immobilized substrates or cells of the endothelia or epithelia or other target cells during simulated physiological shear. The system consists of a closed capillary loop in which fluids are recirculated via a peristaltic pump. The infusion of cells injected into the loop brings about an encounter with monolayers of target cells coating the internal surface of the capillary tubes reminiscent of blood flow in the vascular system. The subsequent adhesive interactions of microbial cells and target cells or ligand bearing substrates are analyzed with the use of a professional-grade video

D39 data acquisition and recording system. The Macintosh® computer system (Apple Computer®, Inc., Cupertino, CA), LG-3 video frame grabber board, (Scion Corporation, Frederick, MD), and Image software (NIH, Bethesda, MD) are customized for real-time and off-line video analysis of adhesion events.--

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Please delete the paragraph at page 63, line 3, and insert the following paragraph:

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D40 --All studies on the blocking of adhesion interactions with anti-adhesin mAbs and peptides are conducted on the LigoCyte® Pharmaceuticals, Inc. Shear Analysis System described herein.--

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Please delete the paragraph at page 65, line 2, and insert the following paragraph:

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D41 --Immunization protocol: Balb/c mice, ranging in age from 8 to 12 weeks, are used for hybridoma and antibody production. Primary immunization antigens are adjusted to 10-20 µg of soluble adhesion molecule or glycoconjugates suspended in .5 ml PBS or  $5 \times 10^6$  or  $5 \times 10^7$  formalin-treated cells are emulsified in CytRx® TiterMax® #R-1 at a 50/50 ratio. In all cases, the subcutaneous (SC) route is used to avoid a toxic reaction in mice. Immunized mice are bled at day 14 to test antibody responses by ELISA or agglutination of intact cells. If a low titer is found, the mice are boosted with similar dose of antigen and bled and tested at day 28. This procedure is repeated at 2 week intervals until the desired antibody titers for both antigens are achieved.--

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Please delete the paragraph at page 65, line 18, and insert the following paragraph:

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--ELISA screening protocol: ELISA assays employ Costar® universal covalent surface immuno assay plates and standard protocols for binding of the bacterial and host antigens. The system employs a two or three stage development system in which the adhesion molecule is covalently bound to the 96 well assay plates by UV cross linking. The first stage anti-adhesin specific mouse serum or hybridoma supernatant antibodies are diluted and incubated in the plate wells after the adhesion molecules are bound and the plates blocked with BSA. After washing to remove non-specifically bound first stage reagents, a peroxidase coupled anti-mouse second stage antibody is added to the test wells, incubated, and washed. Substrate is then added to the wells to develop the assay which is subsequently read by an automated ELISA plate reader. If the desired sensitivity is not achieved, a third stage to amplify signals is employed.--

Please delete the paragraph at page 66, line 2, and insert the following paragraph:

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--Hybridoma fusion protocol Anti-adhesion hybridomas are subcloned and selected as soon as hybridoma cell numbers permit. Subcloning is performed in 96-well plates by limiting dilution in HAT medium. Upon successful ELISA screening of mAb-positive subclones, the hybridomas are adapted to serum-free medium for bulk production of anti-adhesin mAbs.--

Please delete the paragraph at page 72, line 2, and insert the following paragraph:

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--Many microbial attachment molecules, like the adhesion molecules (selectins) of inflammatory cell (leukocytes and endothelial cells) systems, are defined as lectin-like structures or carbohydrate binding proteins (CBP) that mediate adhesive interactions by